

Forces everywhere

Everything you do uses forces. You cannot see forces, but you can often see the effects of a force. A force can change the shape of an object, or make it move faster or slower, or make it change direction. The greater the force, the greater its effect. 'Push' and 'pull' are two types of forces. The magnetic attraction between a magnet and iron is another type of force. All forces are measured in **newtons** or N.

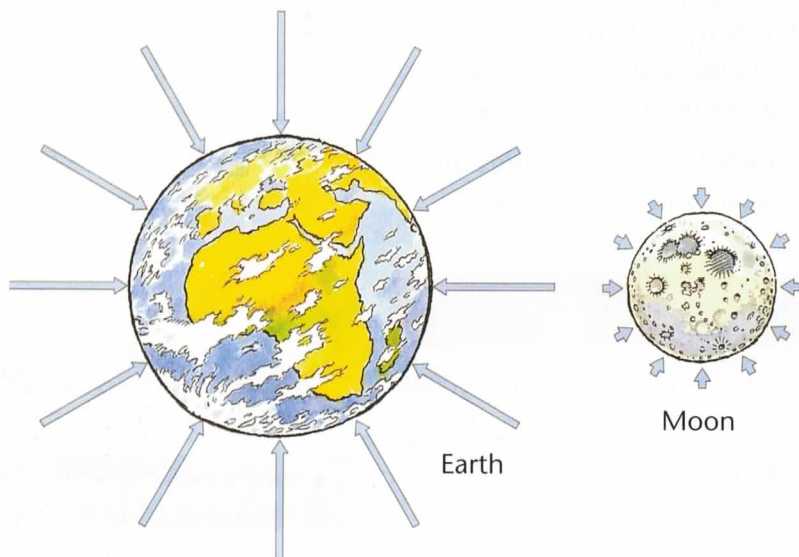
What is gravitational attraction?

Gravitational attraction (gravity) is the force which pulls an object towards the Earth. The picture shows the Earth is shaped like a sphere. Britain and Australia are almost on opposite sides.

Gravitational attraction pulls Sharon and Shirley toward the Earth. The force acts down towards the centre of the Earth.

a Why does Shirley not fall off Australia?

There is also gravitational attraction between the Moon and objects on it. The gravitational attraction on the Moon is weaker than on the Earth.

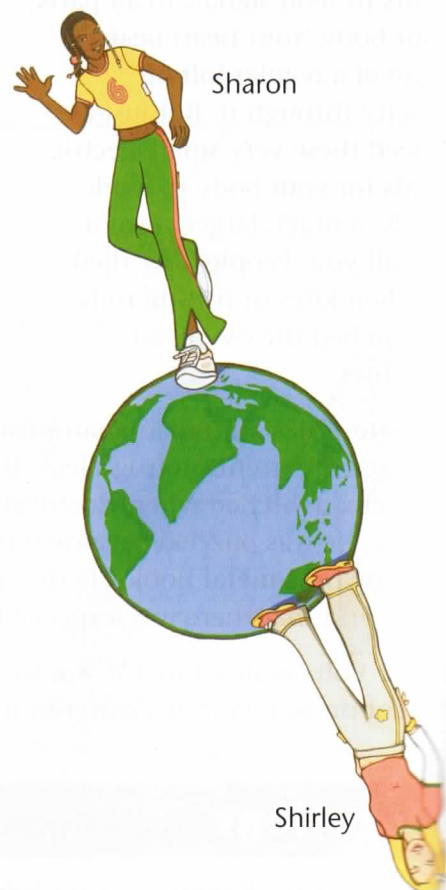


Learn about:

- Gravitational attraction
- Weight
- Mass

Do you remember?

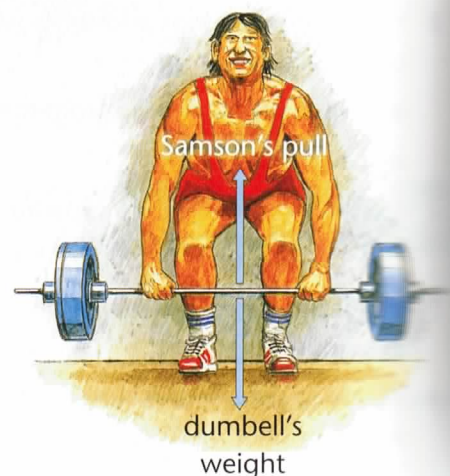
You have used a forcemeter (newtonmeter) to measure forces. The 'newton' is the unit for measuring force.



What is weight?

When you pick an object up off the floor, you are lifting it against a force. This force is the object's **weight**, which pulls it down. In the picture, Samson has to pull with a force greater than the dumbbell's weight to pick up the dumbbell.

We use 'weight' to mean how heavy something is. Weight is gravity acting on an object. Heavy objects are pulled down with a bigger force than light objects. We measure weight in newtons.



Mass and weight

Sharon is made of a certain amount of stuff or **matter**.

Sharon's **mass** is a measure of how much matter she is made of. Mass is measured in **kilograms** or **kg**. She has a mass of 66 kg.

Sharon's weight is different. Her weight is caused by gravitational attraction on her mass. On Earth gravitational attraction has a force of 10 N on each kilogram. So, to find the weight of something on Earth, you multiply its mass by 10. On Earth a mass of 1 kg has a weight of 10 N.

- b** What are the weights on Earth of Sharon and Shirley?

On the Moon

The force of gravitational attraction between two objects depends on the mass of the objects. The Moon has a smaller mass than the Earth, so the Moon has less gravity than the Earth. In fact it is one-sixth of the Earth's. On Earth, Sharon weighs about 660 N. On the Moon she weighs only 110 N.

- c** Explain why Shirley would weigh less on the Moon than on Earth.



Sharon's mass is 66 kg



Shirley's mass is 45 kg



weight 660 N
mass 66 kg



weight 110 N
mass 66 kg

Questions

- Explain what these words mean:
a weight **b** mass **c** gravitational attraction.
- Calculate the weight on Earth of these people:
a Susan, mass 70 kg **b** Philippa, mass 55 kg
c Marco, mass 88 kg.
- Sharon's rabbit has a mass of 6 kg. What is the weight of the rabbit on:
a the Earth? **b** the Moon?
- Explain how mass affects the gravitational force.

For your notes:

- **Gravitational attraction** is the force that pulls an object and the Earth towards each other.
- **Weight** is the force of **gravitational attraction** on an object. We measure weight in **newtons, N**.
- **Mass** is a measure of how much **matter** an object is made of. We measure mass in **kilograms, kg**.